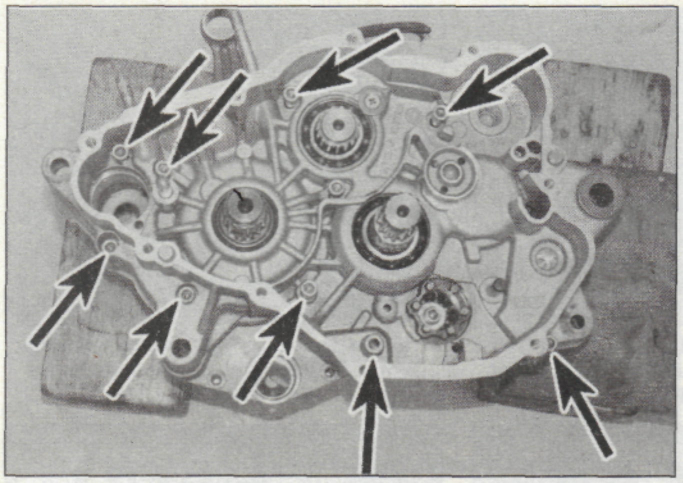
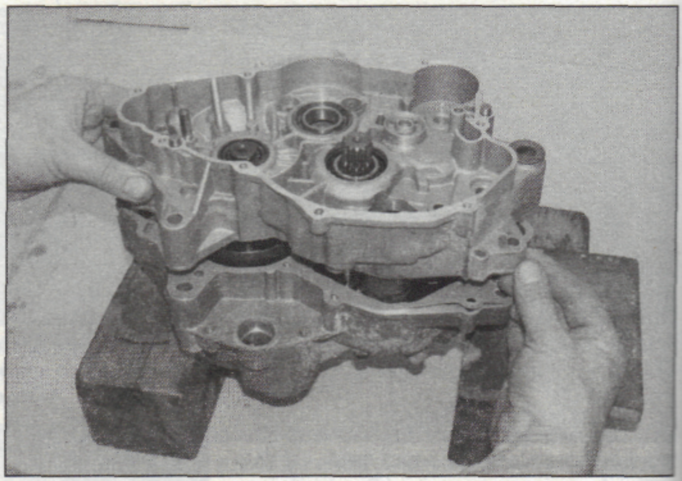


16.4 Undo the crankcase bolts (arrowed) evenly – Type 122 engine shown



16.5a Lift the left-hand crankcase half off the right-hand half

roller on the arm rests in the neutral detent on the selector cam. Note how the ends of the stopper arm spring locate against the crankcase and underneath the stopper arm.

Inspection

15 *Slide the thrust washer, sleeve and* centralising spring off the gearchange shaft, noting which way round they fit **(see illustration 15.13)**.

16 Inspect the splines on the gearchange shaft; if they are worn or damaged, or if the shaft is bent, renew the shaft.

17 Remove the selector arm spring and check it for fatigue, wear or damage. Check the selector arm for distortion and wear of its pawls. Check for any corresponding wear on the selector pins on the selector drum (see Section 19). If necessary, renew the gearchange shaft/ selector arm assembly.

18 Inspect the centralising spring for fatigue, wear or damage. If there is a lot of freeplay in the gearchange lever, and the external linkage *is good, renew the centralising spring.*

19 Lift the stopper arm out of the crankcase, noting which way round it fits. Note the location of the thrust washer. If the stopper arm spring is worn or fatigued it must be renewed. The stopper arm roller should turn freely – if not, renew it.

Installation

20 Install the selector drum (see Section 19).

21 Install the thrust washer and stopper arm and locate the ends of the stopper arm spring against the arm and the crankcase. Locate the stopper arm roller in the neutral detent on the selector drum.

22 Install the gearchange shaft carefully, ensuring the lower end engages with the stopper arm, spring and thrust washer. Locate the pawls on the selector arm onto the pins on the end of the selector drum then press the gearchange shaft all the way in. Install the selector arm spring.

23 Slide the centralising spring and sleeve *onto the gearchange shaft; locate the spring* over the tab on the selector arm, then locate the ends of the spring each side of the locating pin in the crankcase. Slide on the thrust washer.

24 Install the remaining components in the reverse order of removal.

25 Before installing the clutch cover, check the condition of the gearchange shaft seal. If it is damaged or shows signs of leakage, prise out the old seal carefully with a flat-bladed screwdriver, noting which way round it fits **(see illustration 15.11)**. Lubricate the new seal with a smear of grease and press it in with a suitably-sized socket.

16 Crankcase halves and main bearings

Note: *To separate the crankcase halves, the engine must be removed from the frame.*

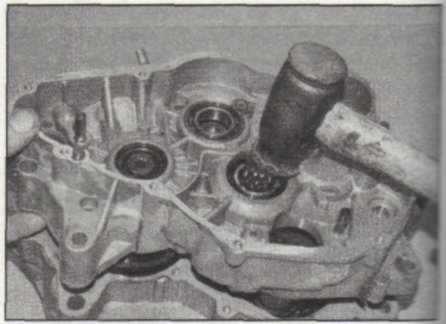
Separation

1 To access the crankshaft assembly, balancer shaft, engine main bearings and transmission components, the crankcase halves must be separated.

2 Remove the engine from the frame (see Section 4). Before the crankcases can be separated the following components must be removed:

- Cylinder head (see Section 6)
- Cylinder (see Section 7)
- Alternator rotor and stator (see Section 10)
- Clutch (see Section 13)
- Gearchange mechanism – Type 122 engine (see Section 15)
- Primary drive gears (see Section 14)
- Water pump (see Chapter 3)
- Front sprocket and O-ring (see Chapter 6)

3 Tape some rag around the connecting rod *to prevent it knocking against the cases.* Although not essential, it is a good idea to remove the piston to avoid damaging it (see Section 8). Ensure the transmission is in neutral. If not already done, remove the O-ring from the crankshaft **(see illustration 14.18)**.

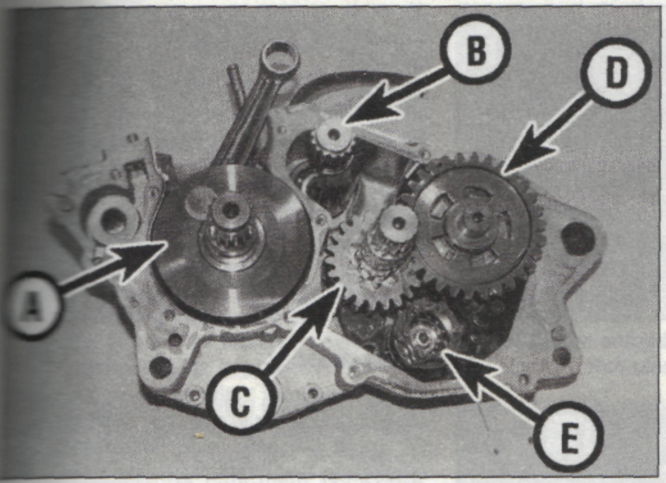


16.5b Tap the end of the transmission input shaft to aid case separation

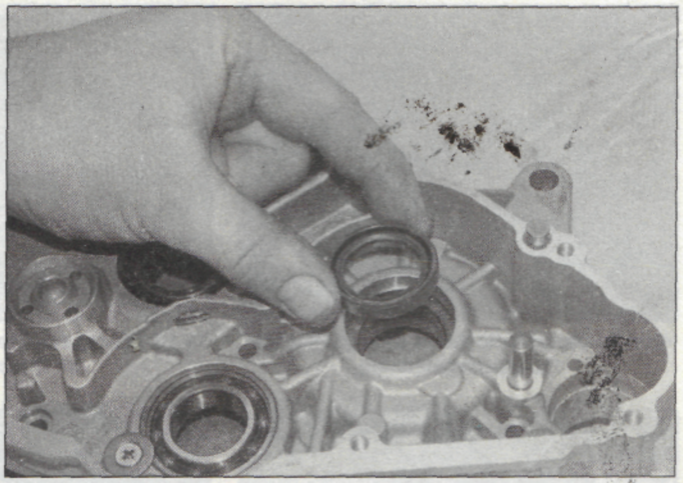
4 Support the crankcase assembly on wooden blocks on the work surface, then unscrew the crankcase bolts evenly, a little at a time and in a criss-cross sequence until they are all finger-tight, then remove them **(see illustration)**. **Note:** *Ensure that all the crankcase bolts have been removed before attempting to separate the cases – there are 9 bolts on Type 122 engines and 13 bolts on Type 123 engines.*

5 Carefully lift the left-hand crankcase half off the right-hand half, tapping around the joint face between the two halves with a soft-faced mallet to free them – don't attempt to lever them apart with a screwdriver, you'll damage the sealing surfaces **(see illustration)**. If necessary, tap the end of the transmission input shaft with the mallet **(see illustration)**. If the two halves still will not separate, heat the left-hand crankcase around the outside of the transmission input shaft bearing housing with a hot air gun. If required, Rotax produce a service tool (Type 122 engines Part No. 277 455, Type 123 engines Part No. 277 160) to *aid separation of the crankcase halves.*

6 The crankshaft assembly, transmission components and balancer shaft should



16.6 Crankshaft assembly (A), balancer shaft (B), transmission input shaft (C), transmission output shaft (D) and gear selector drum (E) in the right-hand crankcase half



16.12 Remove the crankshaft oil seals, noting how they fit

remain in the right-hand crankcase half **(see illustrations)**.

7 Note the location of any thrust washers or shims on the ends of the transmission shafts and either remove them for safekeeping or, if the shafts are not going to be disassembled, secure them in place on the shaft with a dab of grease. Note that the shims sometimes stick to the shaft bearings in the crankcase, so check inside the left-hand crankcase half as well as on the shafts.

8 Follow the procedure in the appropriate Sections to remove the balancer shaft, selector drum and forks, gearchange mechanism (Type 123 engines) and the transmission shafts from the crankcase half.

9 Now press the crankshaft assembly out of the crankcase half. Support the crankcase on wooden blocks so that the left-hand end of the crankshaft is just above the work surface, then heat the crankcase around the crankshaft main bearing housing. If sufficient heat is applied (approx. 75°C) a light tap on the right-hand end of the crankshaft will free the assembly from the case. **Note:** *The crankshaft is a pressed-together assembly – use of undue force could knock it out of alignment. If the crankshaft is not coming free, the crankcase is not hot enough!* If available, the Rotax service tool used to separate the crankcase halves can be used to press the crankshaft assembly out of the crankcase half. Note that the right-hand main bearing may remain on the crankshaft.

10 If fitted, shims for adjusting the crankshaft axial clearance are located on the right-hand side of the shaft. On Type 122 engines, the shims are fitted between the right-hand main bearing and the crankcase (see Step 15). On Type 123 engines, the shims are fitted between the right-hand flywheel and the right-hand main bearing. If applicable, remove the shims for safekeeping.

11 Remove the two dowels from either crankcase half for safekeeping if they are loose.

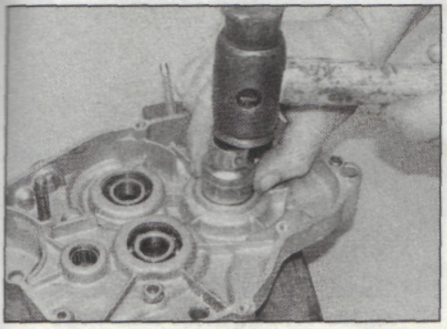
12 Note the position of the crankshaft oil seals and, if accessible, lever them out carefully with a flat-bladed screwdriver. Note which way round the seals are fitted **(see illustration)**. On Type 122 engines, the right-hand seal cannot be removed with the main bearing in place (see Step 15). Discard the seals as new ones must be fitted on reassembly – good condition seals are essential to the running of a two-stroke engine.

Inspection

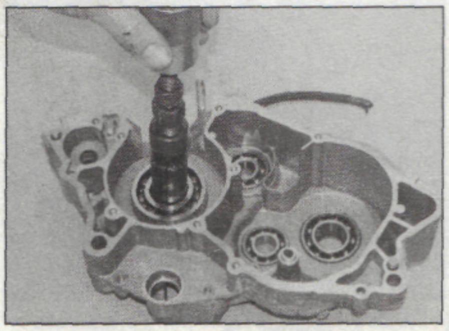
13 If the main bearings have failed, excessive rumbling and vibration will be felt when the engine is running. Sometimes this may cause the oil seals to fail, resulting in a loss of compression and poor running. Check the condition of the bearings – they should spin freely and smoothly without any rough spots or excessive noise – and only remove them if they are unserviceable. Renew the bearings if there is any doubt about their condition and always renew both main bearings at the same time, never individually.

14 Before removing the main bearings, note which way round they are fitted.

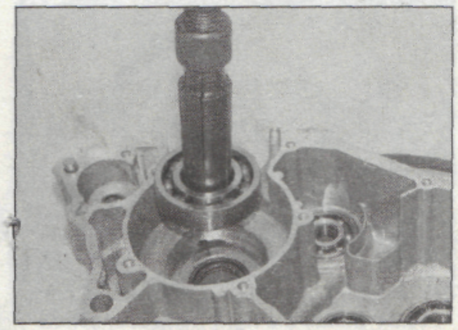
15 To remove the main bearings from the cases, heat the bearing housing with a hot air gun and tap the bearing out from the outside towards the inside using a bearing driver or suitable socket **(see illustration)**. Note that on Type 122 engines, the right-hand main bearing cannot be driven out – a slide-hammer with knife-edged bearing puller attachment is required. Pass the expanding end of the puller through the centre of the bearing, then tighten the puller to lock it against the inner back edge of the bearing. Thread the slide-hammer onto the puller, then operate the slide-hammer to jar the bearing out – if necessary, heat the bearing housing with a hot air gun **(see illustrations)**. Note any



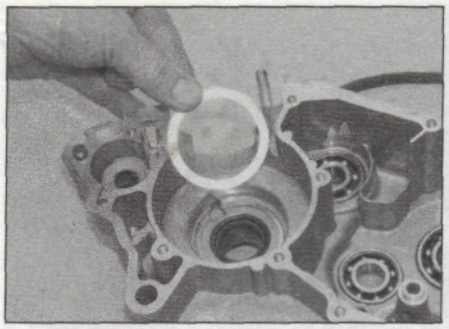
16.15a Driving out a main bearing with a suitably-sized socket



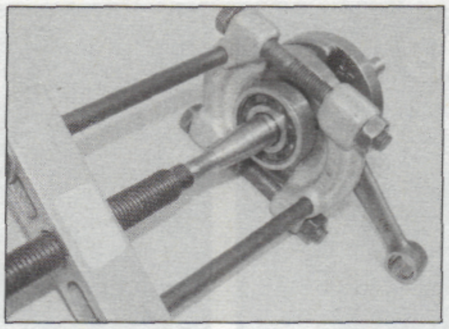
16.15b Using a slide-hammer with knife-edged bearing puller . . .



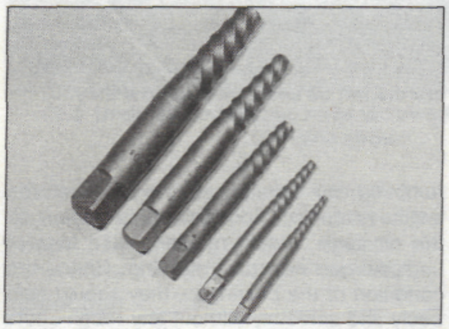
16.15c . . . to extract a crankshaft main bearing



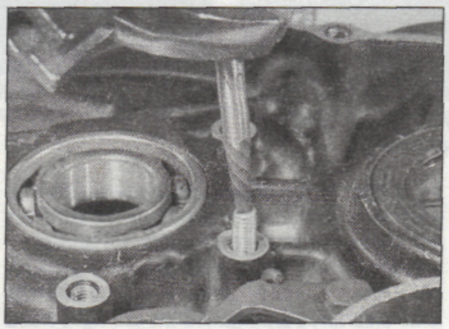
16.15d Note the location of any shims in the bearing housing



16.16 Set-up for drawing the main bearing off the crankshaft



16.19a A set of screw extractors is a useful addition to the workshop



16.19b The extractor is screwed anticlockwise into the broken-off fastener

shims located in the bearing housing **(see illustration)**.

16 To remove the bearings from the crankshaft, use an external bearing puller to avoid damaging the crankshaft assembly **(see illustration)**.

17 Remove all traces of old gasket from the crankcase sealing surfaces, taking care not to nick or gouge the soft aluminium if a scraper is used. Wash all the components in a suitable solvent and dry them with compressed air.

Caution: Be very careful not to damage the crankcase sealing surfaces which may result in loss of crankcase pressure causing poor engine performance. Check both crankcase halves very carefully for cracks and damaged threads.

18 Small cracks or holes in aluminium castings may be repaired with an epoxy resin adhesive as a temporary measure. Permanent repairs can only be effected by welding, and only a specialist in this process is in a position to advise on the economy or practical aspect of such a repair; there are however, low temperature welding kits available for small repairs. If any damage is found that can't be repaired, renew both crankcase halves as a set.

19 Damaged threads can be reclaimed by using a thread insert of the Heli-Coil type, which is fitted after drilling and re-tapping the affected thread. Most motorcycle dealers and small engineering firms offer a service of this kind. Sheared screws and studs can usually be removed with screw extractors which consist of a tapered, left thread screw of very hard steel. These are inserted into a pre-drilled hole in the broken fixing, and usually succeed in dislodging the most stubborn stud or screw **(see illustrations)**. If you are in any doubt about removing a sheared screw, consult an Aprilia dealer or automotive engineer.

20 Always wash the crankcases thoroughly after any repair work to ensure no dirt or metal swarf is trapped inside when the engine is rebuilt.

21 Inspect the crankshaft assembly and bearings (see Section 17).

22 Check the condition of the balancer shaft bearings, the transmission shaft bearings, and renew the transmission output shaft oil seal (see Sections 18 and 20).

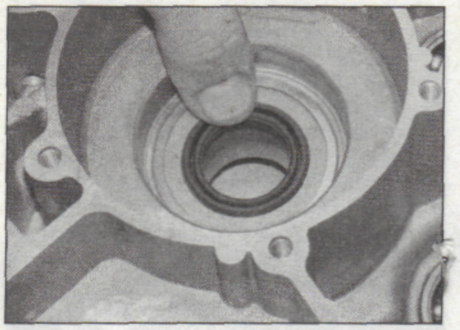
Reassembly

23 If required, check the crankshaft assembly axial clearance (see Section 17).

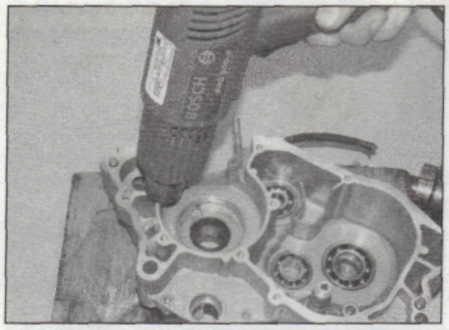
24 To fit the new main bearings into the crankcases first heat the bearing housing with a hot air gun to around 90°C, then press the bearing in using a bearing driver or suitably sized socket. Next fit the new crankshaft oil seals – drive them in carefully to ensure they enter the cases squarely and use a block of wood to ensure they are fitted flush with the outside edge of the crankcase. Note that on Type 122 engines, the right-hand seal must be installed before the bearing **(see illustration)**. Also on Type 122 engines, before fitting the right-hand main bearing, don't forget to install any axial clearance shims **(see illustration 16.15d)**. If the axial clearance has been calculated, the right-hand bearing can be installed together with the crankshaft assembly.

25 Support the right-hand crankcase half on wooden blocks on the work surface. Lubricate the seal with the specified two-stroke oil and tape some rag around the connecting rod to prevent it knocking against the cases. On Type 123 engines, don't forget to fit any axial clearance shims on the right-hand shaft – a dab of grease will hold them in place. Fit the crankshaft assembly, ensuring that the connecting rod is aligned with the crankcase mouth **(see illustrations)**. If required, heat the crankcase with a hot air gun before fitting the crankshaft. **Note:** *Avoid applying direct heat onto the crankshaft oil seal.* Ensure the crankshaft is pressed fully into the bearing.

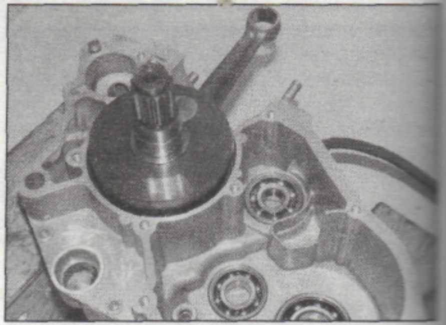
26 Follow the procedure in the appropriate



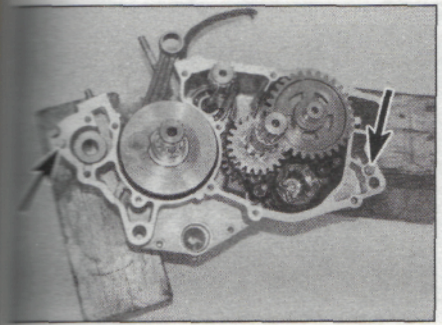
16.24 Install the right-hand crankshaft seal before fitting the bearing – Type 122 engines



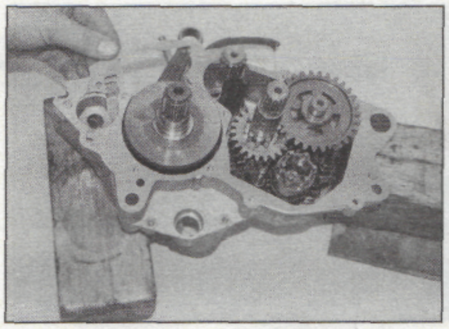
16.25a Heat the right-hand crankcase half . . .



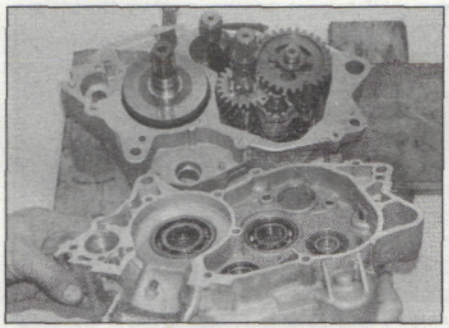
16.25b . . . then fit the crankshaft assembly



16.27a Ensure the locating dowels (arrowed) are in place . . .



16.27b . . . and fit the new gasket



16.28 Fit the left-hand crankcase half onto the right-hand half

Sections to install the balancer shaft, transmission shafts, selector drum and forks and, on Type 123 engines, the gearchange mechanism into the right-hand crankcase half. Don't forget to fit any thrust washers or shims to the ends of the transmission shafts. Lubricate the transmission shafts with the specified transmission oil.

27 Wipe the sealing surfaces of both crankcase halves with a rag soaked in a suitable solvent and fit the dowels, then fit the new gasket **(see illustrations)**.

28 Lubricate the left-hand crankshaft oil seal with the specified two-stroke oil, then fit the left-hand crankcase half onto the right-hand half. Ensure the crankshaft, balancer shaft and transmission shafts are correctly aligned **(see illustration)**. If necessary, tap around the left-hand half with a soft-faced mallet, but do not force the halves together – if they are not fitting, lift the left-hand half off and find out why. **Note:** *Do not attempt to pull the crankcase halves together using the crankcase bolts as the casing will crack and be ruined.*

29 Check that the crankcase halves are seated all the way round, then clean the threads of the crankcase bolts and install them finger-tight. Don't forget to fit the sealing washer to the coolant drain bolt **(see illustration)**. Starting with the inner bolts, tighten the crankcase bolts evenly, a little at a time in a criss-cross sequence, to the torque setting specified at the beginning of this Chapter **(see illustration 16.4)**.

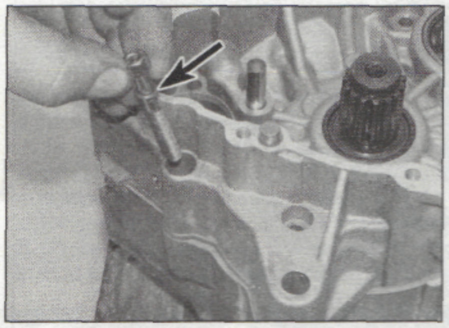
30 Trim off the excess gasket across the crankcase mouth with a craft knife, taking care not to gouge the sealing surface **(see illustrations)**.

31 Lubricate the main and big-end bearings with the specified two-stroke oil **(see illustrations)**.

32 Check that the crankshaft and transmission shafts rotate freely – if there are any signs of stiffness, tap the end of the appropriate shaft with a soft-faced mallet and check again. If the problem persists, it must be rectified before proceeding further.

33 Temporarily install the gearchange linkage arm and check that all the gears can be selected and that the transmission shafts rotate freely in every gear. If there are any signs of stiffness, rough spots, or of any other problem, the fault must be rectified before proceeding further.

34 Install the remaining components in the reverse order of removal.

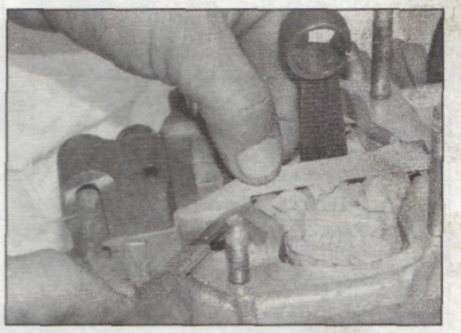


16.29 Note the sealing washer (arrowed) on the coolant drain bolt

17 Crankshaft assembly and big-end bearing

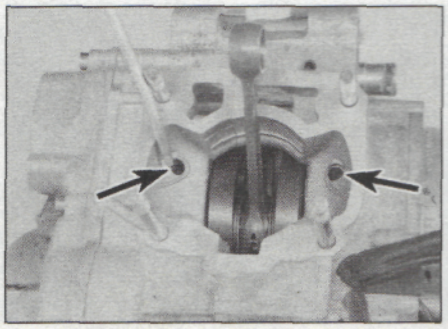
1 To access the crankshaft and the big-end bearing, follow the procedure in Section 16 and separate the crankcase halves, then press the crankshaft assembly out of the right-hand crankcase half.

2 *The crankshaft assembly should give many* thousands of miles of service. The most likely problems to occur will be a worn small or big-end bearing due to poor lubrication. A worn big-end bearing will produce a pronounced knocking noise, most audible when the engine is under load, and increasing as engine speed rises. This should not be confused with small-end bearing wear, which produces a lighter, metallic rattle (see Section 8).

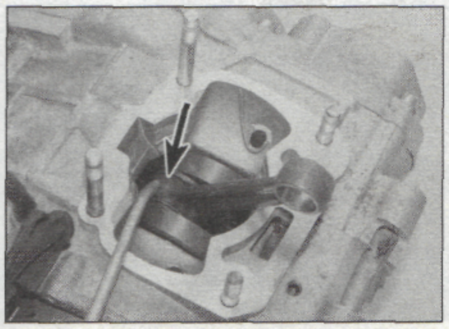


16.30a Trim off the excess gasket . . .

16.30b . . . leaving the sealing surface smooth



16.31a Lubricate the main bearings (arrowed) . . .



16.31b . . . and big-end bearing with clean two-stroke oil